Physical Chemistry I - CHEM 234

Assignment 2: due October 16th, 2014

Show all calculations in your answers

**Question 1 (10 points)**

Set up a thermodynamic cycle for determining the enthalpy of hydration of Ca2+ ions using the following data :

Enthalpy of sublimation of Ca(s) = +178.2 kJmol-1

First and second ionization enthalpies of Ca (g) = +589.7 kJmol-1 and +1145 kJmol-1 respectively.

Enthalpy of vaporization of bromine = + 30.91 kJmol-1

Dissociation enthalpy of Br2 (g) = +192.9 kJmol-1

Electron gain enthalpy of Br (g) = - 331.0 kJmol-1

Enthalpy of solution of CaBr2 (s) = - 103.1 kJmol-1

Enthalpy of hydration of Br- (g) = -289 kJmol-1

**Question 2 (10 points).**

The standard enthalpy of formation of bis(benzene)chromium was measured in a calorimeter.

It was found for the reaction

Cr(C6H6)2 (s) → Cr(s) + 2 C6H6 (g)

that ∆rUΘ (583 K) = + 8.0 kJmol-1.

Find the corresponding reaction enthalpy and estimate the standard enthalpy of formation of the compound at 583 K. The constant-pressure molar heat capacity of benzene is 136.1 JK-1mol-1 in its liquid range, and 81.67 JK-1mol-1 as a gas; they are both considered constant over the temperature range considered. The boiling point of benzene is 353 K.